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ABSTRACT

Piagetian research provides the focus of this article in which Professor Thomas C. O'Brien interviews Professor Hermina Sinclair. Aspects of children's thinking that prefigure scientific theory construction are described and the influence of schooling in inhibiting or suppressing a theory-building human tendency is briefly discussed. The importance of children's mistakes for further learning is also pointed out. Concluding remarks illustrate the coherence of children's thought across involvement in different activities. (Author/RH)

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The Teachers' Center Project
Southern Illinois University at Edwardsville

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The Child as Scientist

an
interview
with
Professor Hermina Sinclair
University of Geneva

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THE CHILD AS SCIENTIST

A Conversation on Piagetian Research

With Professor Hermina Sinclair
Ecole de Psychologie et des Sciences de l'Education
University of Geneva

And Professor Thomas C. O'Brien
Teachers' Center Project
Southern Illinois University at Edwardsville

O'Brien: The Teachers' Center Project has been very fortunate to have Professor Hermina Sinclair from the University of Geneva as a guest for the past few days. Professor Sinclair's nickname is Mimi. She is one of the most able and widely respected researchers in the world as far as the intellectual development of children is concerened.

Mimi, to start maybe you could tell us where you are in Geneva, what's your title, and so forth.

Sinclair: Geneva, as everybody is beginning to know, is the home of perhaps the most influential school of developmental psychology in the world since it's the home of Piaget and his long time co-worker Barbel Inhelder. Geneva University has various departments and one of those departments of Geneva University is psychology and pedagogy. Both sections work — let me take the term that you like to use — under the umbrella of Piaget's theory.

I work there mainly as a researcher in the development of language, or as I prefer to say, in the acquisition of language. The other sections in this psychology department have other specialties, such as clinical psychology, experimental psychology,

and so forth, but obviously all have something to do with this umbrella of Piagetian theory of development.

O'Brien: One of the aspects of Piaget's research seems to be that the child is an active entity who is coordinating and making sense of things. You've said, in fact, that the young child is a scientist. What does that mean? How is the young child a scientist? That little bitty kid? He can't be a scientist -- scientists are supposed to be big people wearing white coats!

Sinclair: Yes, but that little bitty kid is going to grow up someday and maybe he's going to be one of those white-coated scientists, or one of the black-coated scientists, or whatever color clothes they wear. Would you really imagine that at a certain age, say 20 or 15 or 12, this little kid suddenly changes and magically becomes a scientist? Suppose -- and this is another one of your own images -- you have a little rose growing, do you think that suddenly it's going to produce dahlias?

O'Brien: Can you give some examples of the young child's thinking which show the young child as a scientist or as a beginning scientist?

Sinclair: This is always a bit difficult when one is just talking like we are now. As you know very well yourself, the best way of getting some insight in young children's thinking is not so much to talk about them as to have them around and to look at them -- to listen to them as well, of course -- but especially to look at them. And if you want to go back to the first beginnings of scientific humans you get back to little bitty kids, i.e. babies. You can't really listen to them because they don't say very much, if anything, yet. Still, that's where one has to begin if you think of the Piagetian idea of biological continuity. If scientists are going to be, scientists are already there, practically in the cradle.

I can give you an example which I very much like, which you could possibly see as the beginning of scientific endeavor. In Paris I've been working with some col-

leagues of mine — also very Piaget-oriented developmentalists[1] — Moreno, Rayna, Stambak and Verba and several others. They've been observing the same children regularly every two weeks. Some twelve-months-old, thirteen-months-old children were put on the floor. They had somebody behind them to hold them, but the experimenter didn't do anything except protect them from hurting themselves. They were given a number of objects. There were little open cubes that could fit one into the other. They are on the market, I'm sure. All parents have seen them. And there were some sticks, and some balls of play dough, both of different sizes. The babies were just put in front of these materials and they started playing with them. No encouragement was needed. We were pretty sure that they hadn't played with those things yet because these babies were in a Paris institution where they live all day and so we knew more or less what they were familiar with.

Let me describe what they did. You'd see them beginning to try to put one block into the other. Often they'd already have the right block to put the other one into. That's to say it was bigger; they were trying to get the smaller one into it. Since the blocks have square openings you have to fit them in the right way, and when you're thirteen months old that's not so easy. So although they had the right idea — right idea in quotes -- it wouldn't work. Then you'd see them looking surprised, maybe a bit annoyed - I'm interpreting, obviously -- but you could see that more or less. What you could certainly observe was that many of them would then take the little one and put it into their mouth. Now this was not just sucking, a thing that children do when they are a bit worried or upset or sleepy. They were actually, we think, verifying that indeed this object was something that could be put into something else. In a sense they were saying to themselves, "Yes it can. It goes into my mouth." This interpretation was reinforced by seeing what they did with the bigger cube. They'd put the little one down and put one or two

fingers inside the bigger cube, again, it seems to me, verifying something, this time that the other cube was something you could put something into, that it was a container. Then they would try again.

Now this looks very much like theory verification, checking up. You've got an idea and it doesn't work, but one doesn't let go of ideas just like that. Ideas are good things. You like to hold on to them. So you are going to try a bit more. You are going to ask, "Did I really have the right idea? Couldn't I make it work?" I don't know whether you would regard this as a budding theory-making behavior. I would like to interpret it like that.

O'Brien: I have a hunch, and I'm going to test out that hunch. Yes. And this sort of thing continues throughout life is what your research seem to show?

Sinclair: Well, throughout life is maybe saying a little bit much. In the first place we don't really do research with children older than adolescents. In the second place — and there I'm really going to say something in your field more than mine -- one sometimes wonders whether a certain type of education doesn't do an awful lot of harm to this theory-building human tendency and whether sometimes, as a result, children lose their confidence.

O'Brien: Talk some more about that?

Sinclair: Let me first ask you whether you think this is possible. Am I off the beam? Is it possible that education would somehow or other — I'm not going to say destroy — but let's say inhibit or suppress this very human tendency for theory building, testing one's theory; if it works, go on and try something new, and only if it really doesn't work, change your theory.

O'Brien: I don't think it's possible, I know it's possible. There's no mystery about that one at all. In fact, talk to any teacher of a child aged 11, 12 or 13. Those 13 year olds once were inquiring, exploring 2 year olds. They were organizing and making sense of and finding out and trying out and fitting things together,

physically and intellectually. Now you get many of them at age 13 and they have learned that in school they are not to fit things together; the teacher fits things together for them and gives it to them full-fledged. Teachers of eighth grade and ninth grade children will tell you this over and over again. Any sort of novelty in the school -- novelty outside the school is something different -- the kids will say, "I know that the name of the game is that I should sit and wait for you tell me how to do such and such."

Sinclair: This may be, I suppose, linked to phenomena we are seeing all the time.[2] I'm thinking of a particular bit of research done by Karmiloff Smith and Inhelder. Let me tell you what it was all about. The children were asked to balance a certain number of blocks on a metal bar. Some of the blocks were just rectangular long pieces of wood and they were so easy to put on the metal bar that even 2½ year olds could do it. Other blocks were weighted on one side, either conspicuously with a big bit of metal on it or a little bit less conspicuously with the metal stuck inside.

O'Brien: So you're just asking the child to make a sort of "T", put one block across another?

Sinclair: Exactly, and the one block ...

O'Brien: Should not tip off.

Sinclair: Should not tip off. If you've got a block with one of these conspicuous weighted things on one end, you don't put it at the middle of the length dimension; you put it much closer to the heavy bit. The little kids, about the age of 3 or 3½, were very good at this. They put the thing on, they had their hands underneath, and by feeling which side went down they corrected the point of contact between the block and the support. They pushed the side where they felt it go down until they felt that the block was balancing beautifully, and there we are.

At a little later age they would look at the blocks — and, of course — the simple blocks do balance right in the middle — and the children would announce, "Well, I'll put it more or less halfway." Or they'd say, "I'm trying to put it in the middle." They'd put it in the middle. This works with the simple rectangular wooden blocks but the middle doesn't work for the weighted blocks. Until a certain age they would immediately put the weighted blocks in the middle but they would still be able to do the adjusting. At about 6 or 6½, however, the idea of the middle would become such a strong theory that either they wouldn't think of using their feel for the weight in order to correct things or, even worse, they'd sometimes correct the wrong way, that's to say they'd even push it more to the side they felt go down because that was closer to the geometric middle.

What you see here are children who at first are more or less successful with the problem in a fairly primitive way. All right, you can say this is also a theory — by feeling which side goes down you can know which side you have to push the other way -- but still it's a fairly primitive theory. Then they work out something which is a perfect theory as long as the block has its weight distributed equally. That theory, however, doesn't work when the block is weighted on one side. Now this theory becomes so strong that they go against the evidence of their own feeling for weight.

I can well imagine that if you are a teacher you get upset by things like that. You get upset by the child getting the wrong answers all the time. You may not immediately think of the fact that although he now gets it all wrong (whereas before he got some or maybe all of the questions right) he is now on the way to what is really a theory. Thus you shouldn't immediately cut off what happens to be a wrong theory. In this case the material is telling him that his theory doesn't work and he'll sooner or later let go of the theory anyway. The point is, at least I feel that if

I were a teacher this would be the point, can you arrange matters so that when the child feels that his theory is inadequate — it's not wrong, it's inadequate, it doesn't deal with all the cases, and the material, like in this case, tells him so all the time — he doesn't go back to a more primitive theory of just pushing and feeling but rather moves to a more adequate theory. This new theory would make him say, "Well, with those blocks my theory is okay. With those funny looking blocks with those metal things I'll have to stop and think and find something else." How can you as a teacher find the way to arrange things so that the child neither just falls back on what he had already overcome -- a more simple way of dealing with reality -- nor get the idea that theories are no good and loses all confidence in his own capacity to work things out (and to deal with reality, with people, with what have you) and still not immediately give him the solution because then also loses his confidence in his being able to do it?

O'Brien: So if you tell him he's wrong? You'd better not do that. And if you give him the full-fledged solution? You'd better not do that.

Sinclair: You'd better not do that either. What do you do?

O'Brien: You're saying a couple of things. You're saying that sometimes children's mistakes, or so-called mistakes — they look like mistakes from the adult point of view -- are probably a very natural part of growing and learning. And you're saying another thing, that there's probably a lot of everyday observations one can make of this growth as it takes place, even without the laboratory or the experimental condition.

Sinclair: Indeed. This is a very important point -- the importance of one's interpretation of the mistakes. Another well-known example which has been noticed over and over in children's language is that a very young child will start off by correctly saying "feet," as the plural of "foot."

O'Brien: I have one foot, I have two feet.

Sinclair: Well, they won't say that, but at the one or two word stage they will say things like "Daddy car," and they may say "Feet, cup, sock," things like that. They will say "feet" correctly. Then there will come a time, and this has been noticed amongst other observers by Susan Ervin-Tripp and many others, that they will no longer say "feet;" they will say "foots" or sometimes even "feets." Now that's the kind of mistake which, to you and me, quite obviously is the beginning of the grasp of a rule. It's the kind of saying one treasures as a psycholinguist and says, "Goodness me, my child today gave evidence that he's beginning to have some idea about plurals and plural formation."

O'Brien: He's seen this happen in lots of other cases and he's forming a generalization.

Sinclair: Right. He's heard about tops and mops and what have you and — lo and behold — he constructs by analogy, or maybe already by some kind of rule "foots" or "feets" where he's groping for something that combines what he has often heard — feet and /s/ and his rule which is /s/ at the end of the word. These mistakes are to be treasured. They're not things where you say, "Oh, he made a mistake." Those are signs of something very important happening.

O'Brien: The adult might say, simply, "You're wrong, kid!"

Sinclair: Luckily at that age few adults say that. This is a very simple example of something that happens all the time, not only with very young children but later, say between the ages of 6 and 12. There I think it becomes much more difficult for the teacher or the parent to distinguish between all these different kinds of mistakes — mistakes that are signs of progress or theory-building, mistakes that result from just not having paid attention to a bit of information you were given, and mistakes that are really due to some kind of concept not yet having developed so that

whatever problem the child is trying to deal with is indeed for the moment out of his reach. The three mistakes — maybe there are four, five, or six types of mistakes -- often look the same from the outside. But if the child is to be helped to go beyond those mistakes and do better you cannot treat them in the same way. They are symptoms of something totally different.

O'Brien: All of which is to say then, for parents and for teachers, to look lots at children and be cautious about jumping to conclusions. Maybe we should look for verifying or denying evidence. Maybe we should look for "feets" to happen in several others places and not seize on the single example of the child's doing whatever he's doing.

Sinclair: That, of course, is another very important rule. If you think under the Piagetian umbrella, you try not to judge on one instance or one field of endeavor but you see what's being done by the child in many other situations.

O'Brien: A way of characterizing the sort of thing we've been talking about is that the child constructs reality. I've heard that term used. What does that mean, the child constructs reality? [Editor's note: In another of the Teachers' Center publications, Dr. Frank Murray suggested that we should see children as having a signboard on them saying, "Under Construction." "That's wrong," Professor Sinclair suggested. "The sign should read, "Under Construction -- Self Employed." To say that the child is under construction suggests (as with buildings being built) that the construction is exclusively the result of some external agent.]

Sinclair: I'd like to link that up with what you said just before, that one shouldn't look at one field or just one instance, that the child obviously doesn't decide one day that now he's going to deal with how to classify his toys but at another time deals only with how to make his cars run up a slope. He's dealing with the whole of his reality, all at the same time. He may very well, at a certain point, be further

ahead in one part of dealing with reality than with another. (Some children are awfully good at managing their mothers, for instance. And at gauging up with one parent against the other. That's also an important part of learning how to deal with a child's reality.) Some children are very interested in more mechanical things, like constructing Meccano [or an Erector set]. Other children are more interested in painting and drawing.

If you have some idea of general development in all these areas, you can often see in a drawing the same kind of thing that happens in, say, the child's play with Meccano, or the way he talks to his peers or to his parents. It's all very closely linked. And the younger the child, the smaller the totality of the reality he's constructing. Think of children's drawing, for instance. I don't know whether your children still draw houses with triangular sloping roofs. I suppose you have seen 4 year olds and 5 year olds drawing a chimney perpendicular to the roof instead of straight up in the sky, perpendicular to the ground.

O'Brien: You might say from an adult point of view, that that's wrong. You're saying ...

Sinclair: This is the beginning of a correct relation. The relationship of the 90 degrees is there. But it's done in a small part of the whole reality. It's at the point of contact between the chimney and the roof.

O'Brien: Not yet coordinated with the entire picture.

Sinclair: It's not yet elaborated so that that relationship of 90 degrees can be thought of in relationship to the ground the house is built on. Now these restricted relations will just have to become more extended. What you see in a drawing you will also see in other behavior. You can see it in behavior in school where they make mistakes because their relationships are just too narrow. The relation may be very right but simply not all-embracing enough.

O'Brien: Any advice for a parent who's interested in encouraging the intellectual growth of his children?

Sinclair: I find that very hard to answer. One of the things, of course, is to look, listen, and stay quiet from time to time. The other thing is not to say, "No," too often, though you have to do that sometimes. I feel very strongly that the circumstances you are living in are very important in deciding the limits of what you can do. A mother for whom a knocked-down glass of milk is a catastrophe because she just cannot afford to buy another glass of milk can't let her child experiment with drinking out of the glass himself rather than being fed by mother. I'm afraid that social circumstances like crowdedness and budget will have a big influence on the way you can foster the child's construction of his reality because he's going to make messes and he's going to destroy things. Often you cannot construct without making mistakes, which according to the family's circumstances may be catastrophic or not.

O'Brien: I think in general it would be nice to suggest that Piaget has fifty years of research available to Americans. It's not trivial. It gets at the heart of human intellectual growth. Perhaps we can encourage people to drop into their local bookstore. Let's thank Mimi Sinclair very much for her kindness in joining us and sharing some ideas with us.

NOTES

1. Moreno, L., Rayna, S., Sinclair, H., Stambak, M., Verba, M., Les Bebes et la Logique, Cabiers du C.R.E.S.A.S., Paris No. 14, 1976.

2. Karmiloff-Smith, A., and Inhelder, B. If You Want to Get Ahead Get a Theory Cognition 3. 195-212. 1975.

For further reading, the Teachers' Center Project recommends the following:

(Some sixty publications are available as well from the Teachers' Center Project, all at the cost of printing.)

Flavell, John H., The Developmental Psychology of Jean Piaget. New York: D. Van Nostrand Company, 1963.

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